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Abstract

In the absence of substantial differences in the growth rates of per capita GDP across countries, what are the factors that explain the rapid spread of the HIV infection within a nation? This is an empirical question that needs to be explained. In order to elucidate the correlation between HIV prevalence and economic growth in a sample of 74 low- and middle-income countries, being Muslim and ethnic diversity can be used as main instruments to produce estimates of the effect of HIV prevalence on the growth rate of real GDP per capita that are not affected by the presence of simultaneity.

Key Words

HIV/AIDS, economic growth, religious belief, ethnic diversity, Latin America, Muslim Countries

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Introduction

According to UNAIDS, women in their reproductive age face higher risks of contracting HIV than men because their diminished economic and social status compromises their ability to choose safer and healthier life strategies. Gender-biased discrimination undeniably promotes higher levels of HIV prevalence, which in fact is associated to a mature stage of the epidemic where the mechanism of transmission is through heterosexual intercourse.

Nevertheless, men are vulnerable as well because social norms reinforce their lack of understanding of sexual health issues, and are further increased by the likelihood of engaging in substance abuse (such as alcohol) and of opting for types of work that can entail mobility and family disruption[2]. Among the male population, men who have sex with men (MSM) and injecting drug users (IDU's) are at greater risk due to discrimination and stigma.

In the absence of substantial differences of growth rates of per capita GDP across countries, what are the factors that explain the rapid spread of HIV infection within and across countries? This is an empirical question that needs to be explained and so far the existing literature lacks of a consensus on the real effect of the burden of the HIV outbreak around the world.

[2] See http://www.un.org/ga/aids/ungassfactsheets/html/fsgender_en.htm

In order to elucidate the correlation between HIV prevalence and economic growth in a sample of 74 low- and middle-income countries[3], being Muslim (a proxy for male circumcision, reduced consumption of alcohol and other practices) as well as ethnic fractionalization can be used as main instruments to produce estimates of the effect of HIV prevalence on the growth rate of real per capita income that are not affected by the presence of simultaneity.

This paper is organized as follows: section one describes the role of truly exogenous factors, the so called instrumental variables, such as being Muslim and ethnic fractionalization, in the explanation of the relationship between HIV prevalence and economic growth; section two discusses the HIV/ADIS epidemic in Muslim countries and Latin America, presenting important features of the current state of the disease in these regions, and section three introduces the econometric model utilized in this paper and presents the main findings of the two-stage least squares and the ordinary least squares regressions, and finally, section four portrays the conclusions.

[3] Afghanistan, Algeria, Argentina, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Bolivia, Bosnia-Herzegovina, Brazil, Burkina Faso, Chile, Colombia, Comoros, Costa Rica, Cuba, Djibouti. Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Gambia, Ghana, Guatemala, Guinea, Guyana, Haiti, Honduras, Indonesia, India, Iran, Israel, Ivory Coast, Jamaica, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Malaysia, Mauritania, Mexico, Morocco, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Qatar, Saudi Arabia, Senegal, Somalia, Sudan, Suriname, Syria, Tajikistan, Tanzania, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, UAE, Uganda, Uruguay, Uzbekistan, Venezuela, and Yemen.

1. Religious Beliefs, Ethnic Diversity and Epidemiological Factors that May Explain the Spread of HIV/AIDS

In the Muslim faith, human life is highly valued and a healthy body is considered a gift from Allah. Like other heavenly religions, Islam provides an ethical code for sexual enjoyment and forbids the use of substances, or the overindulgence in and dependence on a psychoactive leading to effects that are detrimental to the individual's physical health or mental health, or the welfare of others.

Being Muslim can be used as a good alternative to estimate certain important characteristics in residents of these nations; for instance, the number of circumcised men, the level of alcohol consumption, post-intercourse hygiene measures, in addition to other risk factors associated to the spread of HIV/AIDS, such as banning extramarital or homosexual sex, among others are distinctive features of this type of population.

Male circumcision practices contrast extensively across countries and many of them have been transmitted through generations or adopted for specific purposes. Circumcision procedures depend on religious beliefs[4]; they are related to cultural grounds as an introduction to manhood as happens in some African ethnic groups;

[4] In Islam, the practice of circumcision does not stem directly from the Koran, but instead from the example of the Prophet Mohammed. It constitutes one of the rules of cleanliness of the Islamic faith. For Jews, it was introduced as part of God's covenant with Abraham; in accordance with this covenant, all infant boys must be circumcised on the eighth day by a trained religious person called a Mohel. (http://www.circumcisioninfo.com/circ_world.html)

it can be performed for reasons of sanitation as in some industrial countries, or are carried out for therapeutic purposes in order to cure diseases such as phimosis[5].

In most Islamic societies, boys are circumcised not as infants but instead between the ages of 2-14. On a social level, circumcision is considered as the religious introduction of a child into his society as well as an important step for the transition to adulthood. This is also the main reason why the circumcision ceremony, which can be quite an elaborate affair depending on the financial means of the parents, is postponed until the child can appreciate the significance of the procedure.

Circumcision is not commonly performed in most European countries, however, in the past few decades there has been a large influx of Muslim immigrants to Europe, and nowadays they form a sizable portion of the population of the countries they live in, such as the United Kingdom, France and Germany. In recent times, the subject of circumcision has become more broadly known through reports in the European media.

Both statistical evidence and the debate in the medical literature (Siegfried, 2003; Wendell, 2004; Werker, 2006; De Walque, 2006) have demonstrated a strong association between low male circumcision rate and high HIV prevalence. The fact that circumcised men appears less likely to acquire HIV infection has contributed to consider male circumcision as a strategy for preventing this sexually acquired infection, raising questions among policy-makers, spiritual leaders of different religions and other sectors of the society.

[5] Phimosis is a medical condition whereby the foreskin of the penis is too tight and can be defined as tightness of the preputial ring with resultant inability to retract a fully differentiated foreskin. In other words, the foreskin is so tight it cannot be pulled back completely to reveal the glands.

De Vicenzi (1994) suggests that following circumcision, the surface epithelium of the glands develops a protective keratin layer, a form of natural condom that protects against some sexually transmitted diseases (STD's). Nevertheless, she recognizes that circumcision alone does not capture the differences in sexual behaviors, transmission patterns of STD's, as well as cofactors and other types of risks associated with the infection of the HIV virus.

Werker (2006) found that national male circumcision rates for several African countries are both a strong predictor of HIV prevalence and uncorrelated with other determinants of the level of output, making male circumcision a strong candidate for an instrumental regression (a truly exogenous variable); furthermore, Werker's conclusions do not support the hypothesis that the HIV pandemic has had any measurable impact on economic growth, savings or fertility behavior in African nations.

Restrictions imposed by religious beliefs probably have diverse consequences on the diffusion of STD's; for instance, Gray (2004) shows that that there is a negative relationship between HIV prevalence and being Muslim, probably explained by circumcision, post-intercourse cleaning, along with proscription of extramarital sex, alcohol consumption, and homosexual sex among several other rules, but also recognizes that Islamic marital codes permit men to marry as many as four wives and divorce relatively easy, potentially increasing the number of lifetime sexual partners, moreover, Muslim laws do not allow condom use, which in fact increases the risk of getting infected with HIV.

In the light of the debate over circumcision as a general health measure to fight HIV/AIDS, Puchalski (2005) discusses the implications at the macroeconomic level saying that religious and cultural thinking can impact health care decision-making and patterns of spending, so it is important that physicians and health care providers talk about spiritual and religious issues in order to implement actions against any disease, including HIV infection.

In the line of this debate, the magnitude of the benefit and the degree of effectiveness of any policy measure oriented to battle the HIV/AIDS pandemic in any capacity, such as a comprehensive health care system, condom distribution, needle sharing programs for IDU's, and so on, has to be carefully analyzed in the absence of any bias or in the presence of strong moral grounds[6].

In addition to our analysis, the other important explanatory variable is ethnic fractionalization, which in some degree promotes the spread of HIV infection within a country, due to the fact that some groups happen to be more vulnerable to contract the disease than others. For instance, United States statistics show that some minority groups, such as African-American and Hispanic males, are more likely to become infected with HIV than white men.

Furthermore, a diverse society perhaps leads to disagreements among policy makers and also on spending priorities. In a seminal paper, Alesina (2003) measured ethnic, linguistic and religious fractionalization for about 190 countries and analyzed their effects on the quality of institutions and on economic growth.

[6] See De Vicenzo (1994). It may imply a contradiction of interests between public health considerations versus religious and the socio-cultural context.

The main objective of his work was to debate of what makes different countries more or less successful economically and what explained the quality of their institutions and policies.

In a cross-country regression analysis, David (2007) obtained estimates suggesting that ethnic diversity plays an important role in the clarification of the relationship between social capital and HIV prevalence; according to his study, a one standard deviation increase in HIV prevalence will lead to 1% decline in trust, controlling for other determinants of social capital. For instance, if an individual moves from a country with a relatively low level of HIV prevalence such as Estonia to a country with high level such as Zimbabwe, one would observe an approximate 8% decline in social capital, controlling for HIV prevalence, economic indicators, institutional quality and social distance[7].

Finally, Cederman and Girardin (2005), using an alternative index that better captures mainstream theories of nationalist violence, established links between ethnicity and conflicts for Eurasian and North African countries. Civil wars and political instability are highly associated to migration movements within and beyond national borders that indeed promote the rapid increase in the incidence of the disease.

2. HIV/AIDS Epidemic in the Muslim World and Latin America: An Epidemiological Spectrum

[7] The distance between different groups of society; the notion includes all differences such as social class, race/ethnicity or sexuality, but also the fact that the different groups do not mix.

The World Health Organization/UNAIDS[8] calculated that the number of HIV positive persons in North Africa and the Middle East, where there is a sizeable number of people following the Islamic devotion, was 460,000 individuals; among them 200,000 were women and 68,00 were cases of newly infected persons in 2006 alone. Even though the estimates for North Africa and the Middle East is very low compared to other developing countries individually, (for instance, several African States, India[9], China, Brazil or Russia) its magnitude resides in the rapid proliferation of the disease experienced in this group of nations within a short period of time[10] and the number of infected women.

The highest number of estimated cases of HIV positive persons (also showing high prevalence among adults) for our sample within the Muslim states are Ghana (0.37 million), Indonesia (0.17 million), the Ivory Coast (0.75 million), Nigeria (2.9 million), Sudan (0.35 million), Tanzania (1.4 million) and Uganda (1 million). Conversely, Afghanistan, Bahrain, Kuwait, Turkmenistan, Bosnia-Herzegovina and Comoros report less than 1000 case of people with HIV (very low prevalence) during 2006.

The structure of the Muslim society and the role of women in the social fabric play an important role in the explanation of the state of the AIDS pandemic in this sample of countries, where heterosexual transmission is the main vehicle of infection within this group of countries. It seems that the epidemic can be

[8] AIDS Epidemic Update, World Health Organization / The Joint United Nations Program on HIV/AIDS, December 2006.

[9] There is an important segment of the population in India devoted to the Islam (14% Muslims or 155 million people).

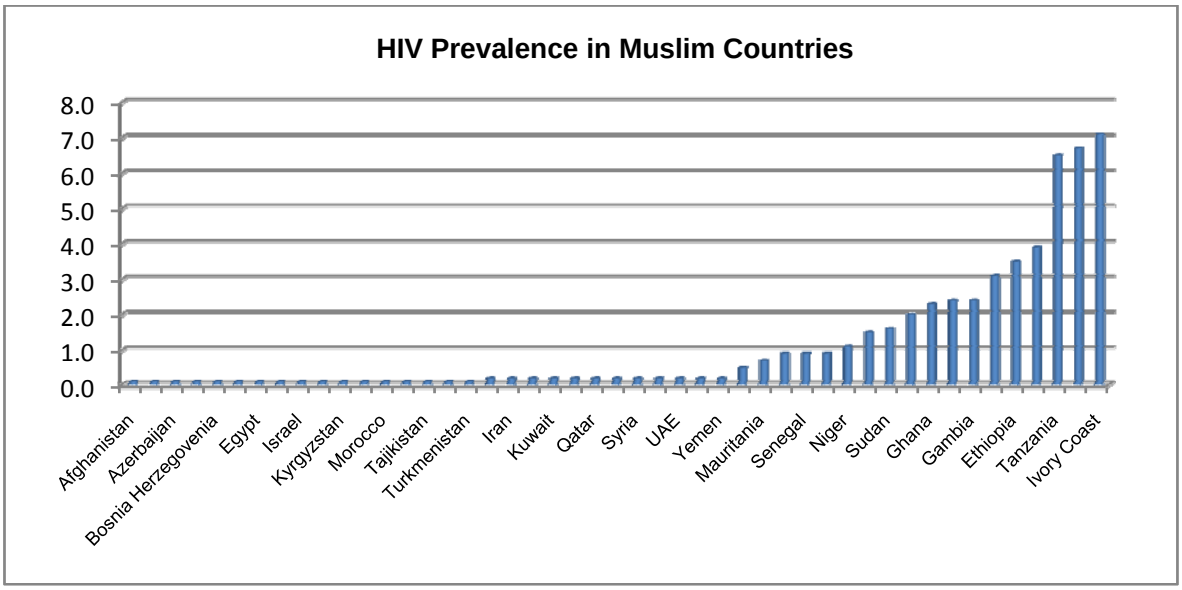
[10] The 2006 Global Report on HIV/AIDS shows that in two years the estimated number of sero-positive individuals increased of more than 25%.

considered to a certain extent generalized, yet showing signs of an overall low prevalence.

In the context of Islam, a Muslim wife is expected to be unconditionally sexually available to her husband and, if she does not comply, she is not eligible for financial support or maintenance. Wadud (2003) estimates that 80% of the heterosexual women with HIV/AIDS are monogamous and have only had sex with their husbands. Women choices are limited to the social structures of marriage and family that prevail once the marriage is consummated. Also, there is an underlying assumption of an overwhelmingly heterosexual order, where sexuality is based primarily upon male sexuality and homosexual intercourse is highly intolerant.

The graph below[11] shows HIV prevalence in Muslim countries for 2006. All the Middle-Eastern countries have insignificant rates (close to 0.1%) whereas some African nations exhibit from moderate to high levels, especially in Tanzania, Uganda and Ivory Coast (more than 6%); nevertheless, this rate is still lower than in other countries in Sub-Saharan Africa.

[11] Source: Report on the Global AIDS Epidemic (UNAIDS/WHO, 2006).



Jenkins and Robalino (2003), analyze the scope of the HIV epidemic in the Middle East and North Africa finding three different patterns: a) type 1, where repeated testing and consistently low rates in general population coexist with inconsistent systemic testing (or reporting) of high risk groups (Egypt, Jordan, Syria and possibly Saudi Arabia); b) type 2, where accumulated levels of infection, gradual and slow, but some rapid increase in identified high-risk groups (Algeria, Bahrain, Iran, Kuwait, Lebanon, Morocco, Oman, Yemen, Tunisia and possibly Qatar and UAE), and c) type 3, with a generalized epidemic levels of HIV (Djibouti, Sudan and probably Somalia).

The World Health Organization/UNAIDS[12] estimated that 1.95 million people were living with HIV/AIDS in Latin America and the Caribbean, where 0.51 million of these cases were women and 0.167 million represented new cases. These figures represent a considerable number of persons if compared with the number of those

[12] AIDS Epidemic Update, World Health Organization / The Joint United Nations Program on HIV/AIDS, December 2006.

infected with the same virus in Eastern Europe and Central Asia together, where the projected figure of sero-positive people were around 1.7 million or in the United States and Canada (1.7 million). More than two thirds of the Latin Americans living with HIV (63%) reside in few countries: Argentina, Brazil, Colombia, Haiti, Mexico and Venezuela where the estimates for this sub-sample of countries were 1.23 million.

The nature and strength of the pandemic is boosted by different factors at the country level. For instance, HIV/AIDS epidemic in Mexico and Peru are primarily driven by men who have sex with men; in Guatemala and El Salvador, commercial sex plays a leading role whereas in Ecuador and Bolivia it is not significant. In a number of Southern Cone countries that transited from dictatorships toward democratic institutions[13] a major driving force has been injecting drug use while in Bolivia, Peru, Ecuador and Venezuela this factor has been limited in scope.

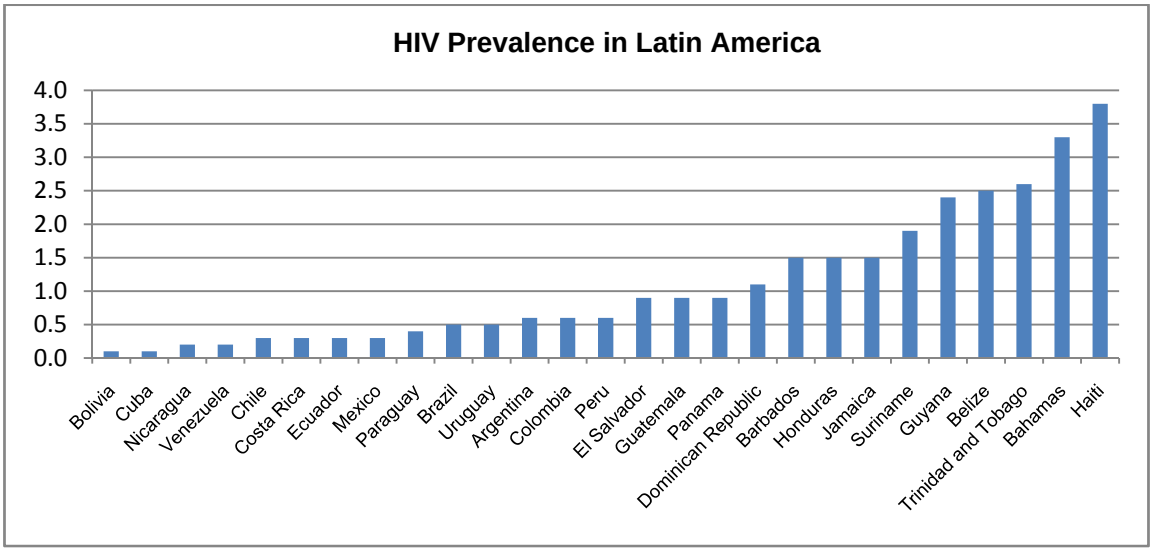
The associated risks of becoming infected with HIV due to migration are present in more than a few countries. For instance, former military regimes in South and Central America, where political conditions and civil wars created a high degree of movement between countries have put migrants at a higher risk. In Mexico, international migration as a result of the weakness of the economic structure is an important component in explanation of this puzzle.

Special attention should be given to the Caribbean countries where the epidemic reflects the global pattern of heterosexual transmission, targeting mainly women and young people. There are several cases illustrating the acute situation of the

[13] As examples of this case we can cite the experience with HIV in Argentina, Brazil, Uruguay and Paraguay.

Caribbean: Haiti (3.8%) holds the highest level in Latin America, followed by The Bahamas, Trinidad and Tobago and Guyana. At the same time, there are nations where the impact of HIV is irrelevant as occurs in Cuba and Puerto Rico[14], with the lowest levels in the region (less than 0.1%).

The following table shows HIV prevalence for Latin American economies[15], where Caribbean and Central American countries exhibit the highest levels of the subsample, but still far out from Sub-Saharan nations.



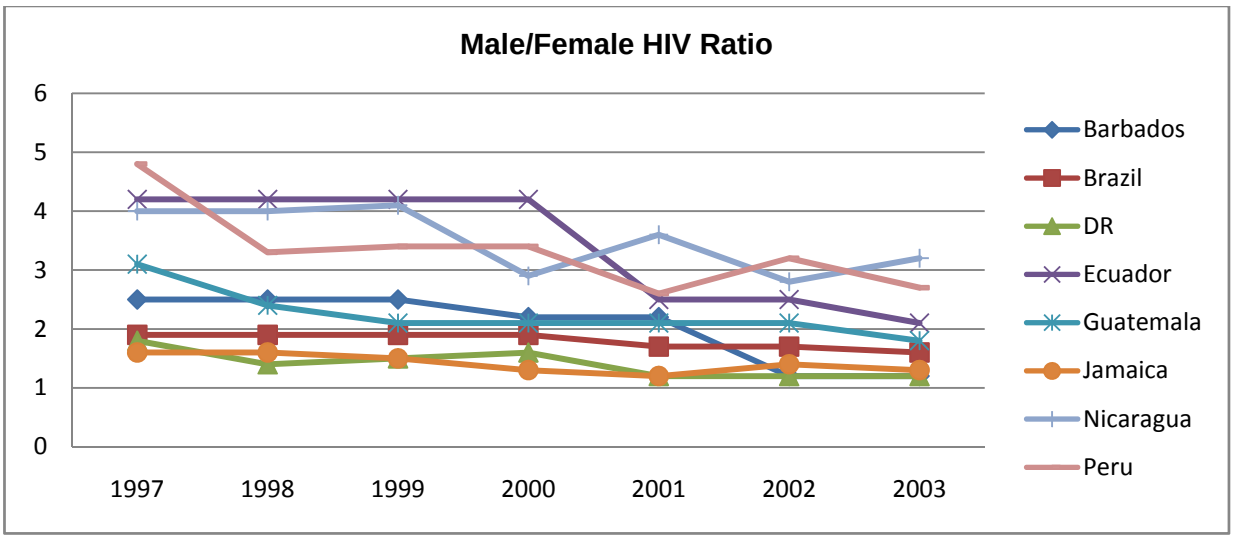
Although it is difficult to make generalizations on the scope of the pandemic in Latin America, there are some common denominators of HIV prevalence in the region such as extreme poverty, increasing gap in income inequality, inefficient health care systems, large migration flows, homophobia, discrimination and stigma

[14] Puerto Ricans have access to health care services in the US. Migration movement is rooted in Puerto Rico's poverty and in its curious status as a stepchild of the United States - a status that has hindered the development of AIDS services in Puerto Rico but allows the island's residents to travel to New York for what they cannot get back home (NY Times, June 15, 1990)

[15] Source: Report on the Global AIDS Epidemic (UNAIDS/WHO, 2006).

as well as the inability to implement a general framework of policy-making decisions due to strong differences in the nature of the epidemic.

Furthermore, there are worrisome signs that the disease is moving rapidly from being concentrated among high-risk groups to becoming generalized (the so called feminization of the epidemic) as occurring in Barbados, Brazil, the Dominican Republic, Ecuador, Guatemala, Jamaica, Nicaragua and Peru (see the graph below). As a matter of fact, in Brazil, where one of the most successful attempts to tackle the epidemic has been implemented, the gap in the male to female ratio has been shrinking dramatically during the past years and seems to get deeper[16] every year. There is no doubt that when governments do not take actions to stop the disease, the problem would eventually get worse.



Garcia (2003) argues that the response to the threat of HIV/AIDS has been slow, small-scaled and largely supported by external agencies and international programs. In this regards, financial aid programs from industrial economies and

[16] AVERT, a British think tank, reports that in 1985 there were 28 men for every woman infected with HIV but in 1992 this ratio had fallen to 4 men per every woman in the same situation.

global organizations to assist poor countries to support their fight against the HIV pandemic may explain in several cases the success of some countries, such as those in Central America and the Caribbean, in tackling the disease.

3. Econometric Model and Empirical Results

a) The Data Set

The sample for this study is comprised of 74 developing countries[17] among Latin American nations and those societies where Muslim population is noteworthy; also, the selection of the participant countries was made based on the availability of data that match to economic, political, socio-cultural, and epidemiological information needed for this project.

The collection of the sample includes a highly representative number of countries from these two different groups of nations from North Africa, Middle East and America. There are 47 Muslim and 27 Latin American nations, all of them falling into the category of low- and middle- income economies, and where Muslim population, ethnic-linguistic fractionalization and HIV prevalence vary substantially across countries.

GDP per capita[18] and meaningful figures for the sample were constructed using information from Heston and Summers data set. Instrumental variables and other essential statistics that matched to economic and socio-demographic figures were

[17] The only exception of a developing country in this sample is Israel, included for this analysis because the percentage of Muslim individuals is very significant.

[18] The average rate of growth of GDP per capita has been used to eliminate short-term variations; however, this can be a biased measure due to the fact that it does not recognize the welfare of the generation that died due to lack of health or HIV/AIDS (Barro, 1997; Bonnel, 2000).

found also in the Human Development Report (UNDP, several years), the World Development Indicators (World Bank, several years), World Mortality Report (UNDP, 2005), and the Population, Resources, Environment and Development: The 2005 Revision (UNDP).

The HIV/AIDS prevalence[19] estimates were obtained using information from the Report on the Global AIDS Epidemic (UNAIDS/WHO, 2006) and the Human Development Report (UNDP, 2006). Miscalculation and inaccuracy of the prevalence of HIV/AIDS are suspected in our sample due probably to inadequate methods of surveillance[20]. Throughout Latina America and Muslim states, there are wide variations in the availability and reliability of HIV testing, identification of people who have progressed to AIDS and would eventually die, misreporting the causes of death, completeness and timeliness of cases reported and epidemiological surveillance[21].

This paper focuses on 1990-2004, which is obviously relevant in the historical analysis of the HIV/AIDS epidemic in Latin America and Muslim Countries because most likely the illness progressed rapidly during this time. Low prevalence is usually associated with a concentrated epidemic whereas high prevalence relates to a generalized one. A paradox of this group of countries is that the HIV

[19] It refers to the proportion of adults aged 15 to 49 years old per 1,000 inhabitants infected with the HIV virus. It is calculated by dividing the number of adults aged 15 to 49 years who are found to be infected with HIV in a given year by the population of adults of the same age group.

[20] India released new estimates of HIV infections in the country that equal about half of the 5.7 million figure produced by UNAIDS. The new estimate was based on a survey of the total population that provides a more accurate measure of the extent of the problem than prior studies. Similar results in other countries have caused some to question the reliability of the figures from the United Nations Global AIDS program.

[21] The calculation on HIV prevalence took into consideration two different types of epidemics at the country level (generalized and concentrated).

epidemic experienced in Latin America and Muslim nations is of low prevalence but appear together to a generalized spectrum of the disease.

b) The Econometric Model

The equations below associate the growth rate of real per capita income to a number of variables, whose relationship has been well established in the growth literature (Mankiw, Romer and Weil, 1992; Levine and Renelt, 1992, Barro, 1991). This approach is documented in the enormous body of work utilizing cross-sectional analysis looking for links between the average growth rates over certain period of time and an assortment of economic, political and socio-epidemiological aspects.

Our econometric representation captures the feedback effects of HIV prevalence on economic growth without the presence of simultaneity. In this type of system, an endogenous change is one that comes from inside the model and is explained by the model itself. In the linear regression analysis, any variable that is explained by independent variables is endogenous and are usually shown on the left hand side of the equation.

An instrumental variable regression is needed to break this simultaneity. This method provides consistent as well as efficient estimators, and the most widely technique used for this purpose is the two-stage least square (2SLS), which is an estimator that consistently offers an educated guess of the regression model with endogenous explanators by first constructing a proxy for the troublesome variable

and then replacing the troublesome variable with its proxy in ordinary least square (OLS) regression.

The econometric model is explained as follows:

1) GDPGR9004 = β_0+ β_1HIV + β_2LOGGDP90 + β_3GDPGR8090 + β_4HK + β_5OPEN + β_6INVEST + β_7GOVEXP + β8FERTIL + μ_i

2) HIV = γ_0+ γ_1MUSLIM + γ_2ELF + γ_3URBAN + γ_4HDI+γ_5POLRISK+ γ_6MIGRA + ε_i

In equation 1 or the second stage of the regression, GDPGR9004 is the average rate of growth of GDP per capita during 1990 and 2004 for Muslim and Latin American countries; HIV is the prevalence of HIV in adults during 2006; LOGGDP90 and GDPGR8090 are the logarithm of the initial level and the lagged rate of growth of GDP per capita; HK is the stock of human capital measured by the net secondary enrolment; OPEN, exports and imports as a share of GDP, captures the links of the domestic economies with the international trade flows; INVEST is the private expenditures as a share of the GDP during 1990-2004; GOVEXP represents the percentage of government spending on military goods for 2004 as share of the GDP, and FERTIL computes the average of fertility rates between 1990-2004 in our sample.

The reduced form or the first stage of the regression shows the equation of HIV prevalence at the country level as a function of MUSLIM (the percentage of the population following this religious belief), ELF (ethnical diversity or the degree of fractionalization within a society), URBAN (the share of urban population between 1990-2004), HDI (the human development index as a proxy for the access to health services), POLRISK (the political risk index from the International Country

Risk Guide) and MIGRA (net migration index). β, γ are vector of parameters that need to be estimated in the regressions, and μ_i, ε_i are the error terms for each equation.

c) Simple Statistics

A simple statistical analysis shows that the average HIV prevalence per 1,000 inhabitants for the 74 countries is 1.11 (SD=1.55), with a maximum of 7.1 experienced by the Ivory Coast and a minimum of 0.1 in Middle Eastern and North African countries; in general, HIV prevalence is low in both Latin America and Muslim countries, especially if compared with most Sub-Saharan African nations.

Real GDP per capital between 1990 and 2004 varies significantly in the sample. The average growth rate is 1.45 (SD=2.12), with the best performance for Bosnia and Herzegovina (8.36) and a noticeable decrease of economic activity in Afghanistan (-6.02) during this time. The average level for the sample is $5,970.26 (s.d=$6,389.52), with a maximum value of $29,158.28 in Kuwait and the lowest level in Eritrea ($605.38).

Fertility rate is very high in the sample with an average of 3.57 (SD=1.56), showing an alarming 7.9 in Niger and a low rate in Bosnia and Herzegovina. The overall population growth rate experienced in this group of countries for the period analyzed is significant with an average of 1.92, (SD=1.18). Population growth is important because an increase in the number of people have potential large effects on many aspects of human lives such as social structures, markets, education, health services, the environment and employment.

The globalization process along with the external sector of the economy are also relevant for the countries in the sample and the average degree of openness is 80%, with the highest for Guyana and the lowest for Somalia. Also, government expenditures, measured by outlays in military goods with an average of 6.46 (SD=4.1) and private investments with an average of 11.59 (SD=5.58), is an important variable that help to describe the composition of these economies.

Social indicators of welfare, such as life expectancy at birth[22] (average=65.27, SD=10.10) and educational attainments (average=5.38, SD=2.06) vary extensively in the sample. There is a gap of 35 years in life expectancy within the sample, where a person lives longer in Israel (79.7 years) but life is cut short in Nigeria (43.3 years). In regards of the level human capital, the average is 5.4 years of education (SD=2.1), where the highest level is given in Israel (9.6 years of schooling) and the lowest occurs in Niger (1 year of schooling); the average of secondary school enrolment in the sample is 53% (SD=25.4).

Finally, the average number of population Muslim is 51% in the entire sample (SD=0.46). In several North African and Middle Eastern countries (Saudi Arabia, Afghanistan, Algeria, among others) almost the entire population follows the Islam, whereas in Latin American the number of Muslims is either insignificant or inexistent[23]. Furthermore, the ethnic linguistic fractionalization index (Alesina, 2003) shows that diversity within society falls in the scale of 50% (SD=0.26), with

[22] Life expectancy reflects differences of level of income among countries, which in fact reflects the amount and quality of health services available for society as well as its accessibility.

[23] There is a very small share of Muslims in Guyana, Brazil and Argentina.

a pretty dissimilar community in Uganda and Tanzania but a homogeneous group of people in Haiti and Egypt.

d) The Results

Due to premature death or disability, high rates of HIV infection potentially affect both the volume and the productivity of the labor force, reducing the rate of growth of per capita income and causing feedback effects on the spread of HIV within a country. Conversely, given low rates of HIV prevalence the impact of the epidemic on economic growth may conform "normal" expectations (Dixon, McDonald and Roberts, 2001; McDonald and Roberts, 2004).

The relationship between national HIV prevalence and its determinants can be analyzed through a series of scatter plots (graph 2). As expected, HIV infection is negatively associated to Muslim population, the level of well-being, income per capita, life expectancy and political risk suggesting that improvements in these factors would probably reduce the rate at which the disease spreads out in the country at certain point in time. Also, HIV prevalence seems to be positively related to ethnical diversity implying that a dissimilar social structure promotes an upward shift in the rate at which the illness can be passed on to other individuals within a country.

Table 2 shows a surprising result in a simple regression of the rate of growth of real per capita income on HIV prevalence: there is a positive association for the whole sample, high prevalence countries and Muslim nations; in all cases the parameters estimated are sizeable and significantly different from zero at a 10%

level of confidence, and the only exception is the estimate for Latin America where the estimate is not significant. This preliminary result seems to be associated to the low levels of HIV prevalence experienced in the entire sample and probably to the fact that the net impact of a health crisis may have had a positive impact on economic growth.

Table 3 summarizes the results for the main determinants of the HIV infection in the entire sample, across Latin American and Muslim countries as well as in nations where prevalence is higher than 2%[24]. The multivariate regression model was highly significant and accounted for a relative elevated portion of the variance in national HIV prevalence rates[25]. Of the 7 predictor variables for the entire sample Muslim population, ethnic diversity, the degree of development, net migration and the availability of infrastructure are very significant. Only urban population and rule of law were not significant, however, the signs of the estimates show the expected effect on HIV prevalence.

Both Muslim populations as a proxy for male circumcision, low consumption of alcohol, heterosexual sex and post-cleaning intercourse as well as ethnic diversity seem to be good predictors of the disease as expected. The coefficient of determination or how much variation is explained by independent variable in this cross-country regression is very high for the whole sample, Latin America and Muslim countries.

[24] Although 2% is not considered a high-level epidemic, for this group of countries it is a useful way to break down the sample. The highest level of HIV prevalence for this group of countries is 7.1% in a Muslim country and 3.8% in a Latin American nation.

[25] For the entire sample (Prob>F=0.0000, R^2=0.51), for the High Prevalence sample (Prob>F=0.0941, R^2=0.384), for Latin American countries (Prob>F=0.0005, R^2=0.5197), and for Muslim countries (Prob>F=0.0001, R^2=0.6304).

Also, using a standard measure for the impact of economic policies on quality of life (human development index), the estimate appears to be a meaningful element that determines the path of the disease. In this case, the degree of maturity of the economic environment, most likely associated to the endowment of health services, explains the success of the efforts to prevent the disease across countries. Improvements in the economic structure lower significantly the rate at which HIV infection is spread out at a point in time.

Assuming that health capital is determined by health status, in particular by the number of people infected with HIV at certain point in time, the net implications of an epidemic are indeterminate in the augmented Solow model (Dixon, McDonald and Roberts, 2001). In this analytical framework, if labor force growth rate declines due to the effect of the epidemic, with everything else constant, both capital per unit of labor as well as income per capita increase. If saving rate declines, other thing being equal, both capital per unit of labor and income per capita decrease.

If both labor force growth rate and saving rates decline at the same time, ceteris paribus, the outcome is not determined since the final result depends on the relative change in labor force growth and saving rates. Moreover, if the effect of a decrease in the size of labor force is translated into losses of productivity, the production function will shift downward reducing both capital per unit of labor and income per capita.

In this set of circumstances, Tables 4 and 5 introduce very interesting results for our OLS and 2SLS regressions of the growth rate of real GDP per capita on HIV

prevalence controlling for several factor that influence growth, which relationship has been established in the current literature. In all cases, the estimated parameters showed a strong positive relationship between HIV infection and the growth rate of real per capita income, suggesting that at this low stage of the epidemic HIV has not impacted economic performance, as suggested in other studies (Werker, 2006;).

A possible explanation for this result is that a decrease of the rate of growth of the labor force due to the impact of AIDS has contributed to improve real income per capita, at least during the low stage of the epidemic. Over (1992) has suggested that a higher level of income perhaps is associated to higher levels of commercial sex practices due to the fact that sex may be consider a normal good.

As expected, the initial level of GDP per capita is negatively associated to the rate of growth of real income and is highly significant in all cases, implying that the convergence property is quite strong. In the same way, improvements in the quality of and access to health services (measured by life expectancy) will increase the stock of health capital boosting economic growth.

Government spending in military goods as a proxy for public consumption and private investment, both as share of GDP are also important explanatory variables in this equation demonstrating that higher levels of public and private investments have boosted output. The degree of openness (exports plus imports as a share of real GDP) and human capital do not support the hypothesis that gains in these factor influence economic growth.

4. Conclusions

An instrumental variable estimation approach was implemented to evaluate the impact of the HIV epidemic on economic growth. The result of this assessment provides does not support to our original hypothesis that the HIV/AIDS epidemic has worsen economic performance during the period analyzed for the group of 74 countries, probably due to the low levels of the epidemic.

Nonetheless, it does not mean that HIV infection is irrelevant in Latin America and Muslim countries. On the contrary, there exist worrisome signs that these nations are moving towards high levels of HIV prevalence rapidly, and also seems that at this particular stage of the outbreak low levels of HIV prevalence coexist with some characteristics of the generalized epidemic, such as a reduce in size of the male to female ratio.

In our econometric analysis, the percentage of Muslims negatively predicted national HIV prevalence; this result supports the hypothesis that HIV prevalence is lower among Muslims perhaps due to some attribute of this type of population such as male circumcision, low consumption of alcohol and sexual practices. Also, ethnic fractionalization positively forecasted the path of the epidemic suggesting that social diversity may promote an increase of the HIV epidemic.

Rapid demographic, epidemiological, social and economic changes have caused the virus' spread in several countries of Africa, Central Asia, Eastern Europe and Latin America. The HIV epidemic has been particularly responsive to large movement of people across borders, warfare, economic cycles and other drastic

variations in the social fabric. The nature of the epidemic responds to some factors such as being Muslim and ethnical diversity, which in fact seems to be good predictors of the course of the illness.

Even in low prevalence countries the situation can change rapidly with devastating consequences as occurred in other places such as in Nepal and Indonesia. The extent of government intervention and the social cost of delaying action to fight the HIV/AIDS epidemic are some of the main concerns connected to this problem.

Both Latin America and Muslim Countries have the opportunity to avoid the devastating effects of the HIV/AIDS epidemic if sound and timely policies are implemented in order to improve their economic structure, institutions and health care systems.

The discussion in the policy arena where governments have a key role in implementing a course of action to confront HIV/AIDS, especially for developing countries, can be enrich from empirical work that explains the burden of the disease and the experience of other countries to overcoming the situation. Interventions which focus on reproductive health and HIV education at several levels, target STD's treatments for highly vulnerable groups (sex workers, homosexuals, truck drivers, etc.), and harm reduction for injecting drug users have proven to be cost-effective (Robalino, 2002).

Women's full participation in society can significantly reduce the spread of HIV/AIDS in developing countries. When priorities to fight the disease are based upon high moral grounds the effectiveness of the programs are often limited.

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TABLE 1: Basic Statistics for Latin American and Muslim Countries

	Mean	St. Deviation	Maximum	Minimum
HIV Prevalence per 1,000 inhabitants	1.11	1.55	7.10	0.10
Growth Rate of Real GDP per capita 1990-2004	1.455	2.117	8.363	-6.019
Real GDP per capita 1990-2004	5,970.26	6,389.52	29,158.28	605.38
Population Growth Rate	1.92	1.18	6.50	-0.30
Number of cellular phones per 1,000 inhabitants	250.49	246.98	1057.00	3.00
Real GDP in 1990 (Initial)	5,531.20	5,731.47	28,580.99	463.73
Income Inequality Index	42.87	9.77	61.00	19.00
Life Expectancy at Birth	65.27	10.10	79.70	43.30
Educational Attainments	5.38	2.06	9.60	1.00
Population Muslim (Percentage)	0.51	0.43	1.00	0.00
Ethno Linguistic Diversity	0.50	0.26	0.92	0.01
Fertility Rate	3.57	1.56	7.90	1.30
Share of Government Expenditures (90-04)	2.88	2.73	12.00	0.10
Degree of Openness [(X+M)/GDP]	80.282	52.68	278.65	3.71
Share of Investment expenditures (90-04)	11.59	5.58	25.06	3.29

Table 2. Rate of Growth of GDP Per Capita and HIV Prevalence (OLS)

* Significant at 1% ** Significant at 5% *** Significant at 10% (Robust Standard Errors)

GDPGR9004	SAMPLE	HIGH PREV	LATIN AMER	MUSLIM
HIV	0.2660**	0.3085***	0.2395	0.2599***
	(0.1414)	(0.1715)	(0.4113)	(0.1493)
Constant Term	1.1608*	1.0098**	1.1111*	1.2470*
	(0.3149)	(0.4997)	(0.4262)	(0.4272)
PROB > F	0.0641	0.0815	0.5671	0.0886
R-Squared	0.0378	0.0813	0.0195	0.0407
Root MSE	2.0907	1.838	1.7748	2.2838
Observations	74	34	28	47

Table 3. Main Determinants of the HIV Infection Across Countries
* Significant at 1% ** Significant at 5% *** Significant at 10%
(Robust Standard Error)

HIV	Sample	High Prevalence	Latin America	Muslim Countries
Share of Muslim	-1.3469* (0.3071)	-2.6589* (1.1459)	-2.0549* (0.6198)	-2.9055* (1.1837)
Ethnic Diversity	1.4040* (0.5812)	2.0278** (1.0992)	-0.2268 (0.7963)	1.2241** (0.6257)
Human Develop. Index	-7.8083* (1.8346)	-9.2073* (3.8294)	-6.6860** (3.3727)	-8.5881* (1.8105)
Rule of Law	0.0115 (0.0093)	-0.0012 (0.0203)	0.0227*** (0.0129)	-0.0043 (0.0147)
Net Migration	-0.0389*** (0.0247)	-0.0052 (0.1098)	-0.0631 (0.0599)	-0.0378*** (0.0250)
Urban Population	-0.0020 (0.0100)	0.0015 (0.0159)	-0.0172*** (0.0109)	0.0269*** (0.0150)
Infra-Structure	0.0014** (0.0007)	0.0021 (0.0022)	0.0004 (0.0008)	0.0009 (0.0011)
Constant Term	5.7076* (1.0658)	7.0660* (2.1405)	6.2738* (2.2282)	6.8034* (1.3370)
Observations	74	34	28	47
Prob > F	0.0000	0.0941	0.0005	0.0001
R-Squared	0.5198	0.3840	0.5197	0.6304
Root MSE	1.1282	1.5427	0.8256	1.1824

Table 4 Economic Growth and HIV (OLS, 2SLS)
* Signif=1% ** Signif=5% *** Signif=10%
(Robust Standard Error)

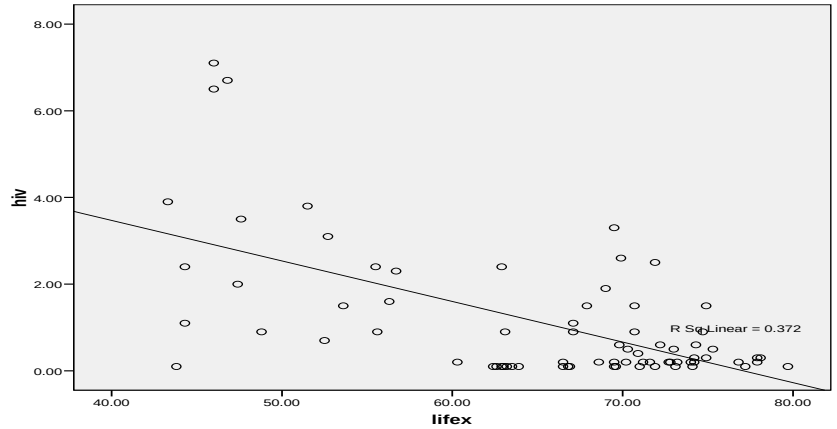
GDPGR9004	Sample	
	OLS	2SLS
HIV Prevalence	0.2659** (0.1589)	1.0323* (0.2876)
Initial Level of GDP (1990)		-1.6767*** (1.0610)
Degree of Openness		0.0028 (0.0050)
Secondary Enrolment Ratio		0.0034 (0.0050)
Fertility Rate		-1.1684* (0.3191)
Government Spending		0.1550*** (0.0896)
Private Investment		0.1086* (0.0490)
Dummy Variable Latin America	-.02178 (0.5077)	-1.3067* (0.5549)
Constant Term	1.2403* (0.3537)	9.3022** (4.4724)
Prob > F	0.2320	0.0002
R-Squared	0.0403	0.3777
Root MSE	2.1026	1.7674
OBSERVATIONS	74	73

Table 5 Economic Growth and HIV Prevalence (OLS, 2SLS)
* Significant at 1% ** Significant at 5% *** Significant at 10%
(Robust Standard Errors)

GDPGR9004	Sample		High Prevalence		Latin America		Muslim Countries	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
HIV Prevalence	0.2660** (0.1414)	1.1996* (0.2647)	0.3085*** (0.1715)	0.7568* (0.1882)	0.2395 (0.4113)	0.7957 (0.6125)	0.2599*** (0.1493)	1.5280* (0.2859)
Initial Level of GDP (1990)		-3.1301* (1.2768)		-2.6985* (1.5030)		-3.7970** (2.1185)		-2.4308*** (1.4475)
Life Expectancy		0.2029* (0.0620)		0.1568* (0.0717)		0.1790 (0.1238)		0.2950* (0.0815)
Degree of Openness		-0.0029 (0.0046)		-0.0041 (0.0051)		-0.0047 (0.0072)		-0.0035 (0.0055)
Secondary Enrolment		0.0101 (0.0131)		-0.0194 (0.0227)		0.0123 (0.0192)		-0.0001 (0.0165)
Government Spending		0.1670** (0.0796)		0.3473* (0.0812)		0.1266 (0.4321)		-0.0311 (0.0942)
Private Investment		0.0860** (0.0450)		0.1334** (0.0702)		0.0621 (0.0696)		0.0744 (0.0523)
Population Growth		-0.1577 (0.3013)		0.7233** (0.4067)		-0.5711 (0.5615)		-0.1433 (0.2539)
Constant Term	1.1608* (0.3149)	-3.5083 (2.9062)	1.0098** (0.4997)	0.2499 (4.4599)	1.1111* (0.4262)	1.4398 (6.6499)	1.2470* (0.4272)	-10.1814* (2.6409)
PROB > F	0.0641	0.0059	0.0815	0.067	0.5671	0.6979	0.0886	0.0009
R-Squared	0.0378	0.3025	0.0813	0.4261	0.0195	0.2554	0.0407	0.4146
Root MSE	2.0907	1.864	1.838	1.4093	1.7748	1.8589	2.2838	1.9468
Observations	74	72	34	34	28	28	47	45

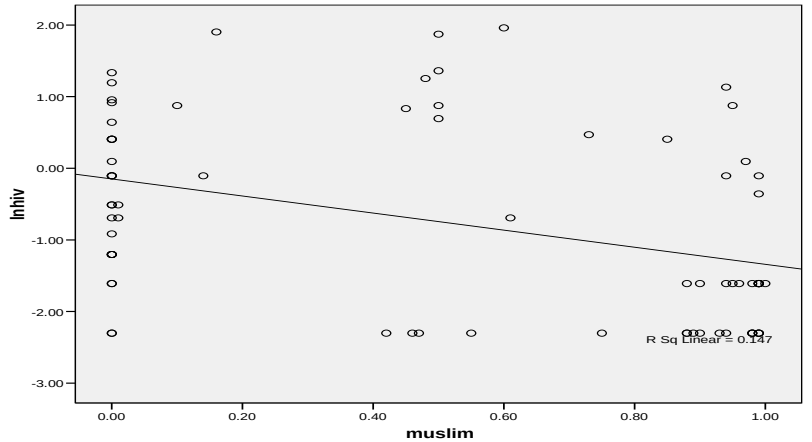
Graph 2: HIV Prevalence and its Determinants

C) HIV PREVALENCE AND LIFE EXPECTANCY



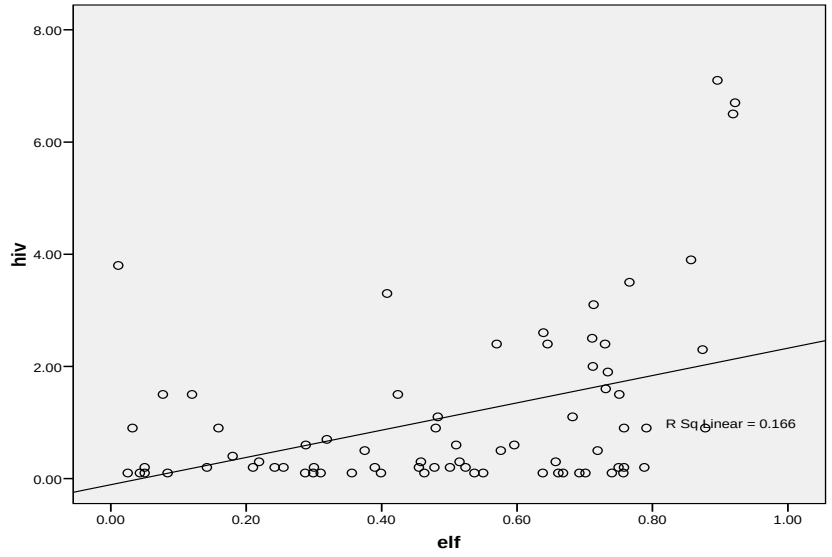
B= -0.0940 (s.e.=0.014)

D) HIV PREVALENCE AND POPULATION MUSLIM



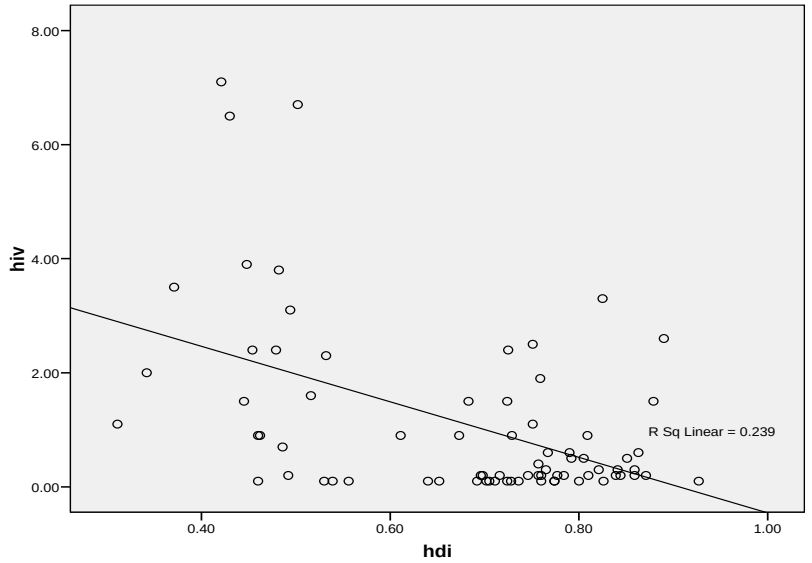
B=-0.7810 (s.e.=0.415)

E) HIV PREVALENCE AND ETHNIC DIVERSITY



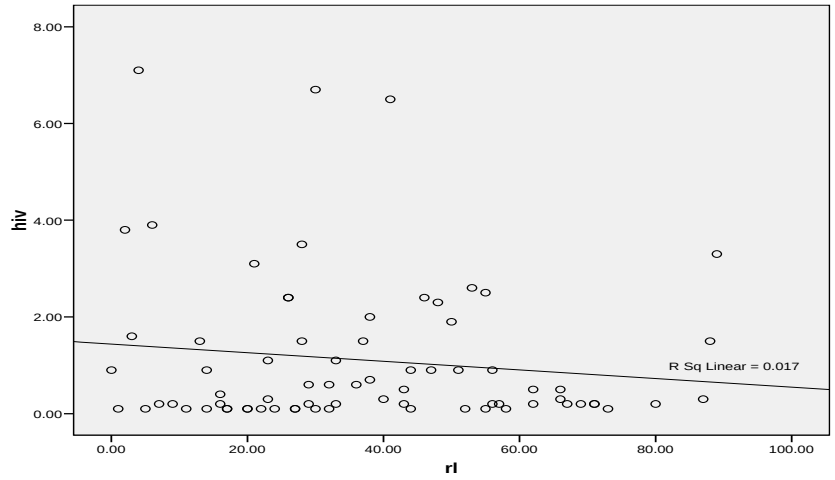
B= 2.434 (s.e.= 0.642)

F) HIV AND THE HUMAN DEVELOPMENT INDEX



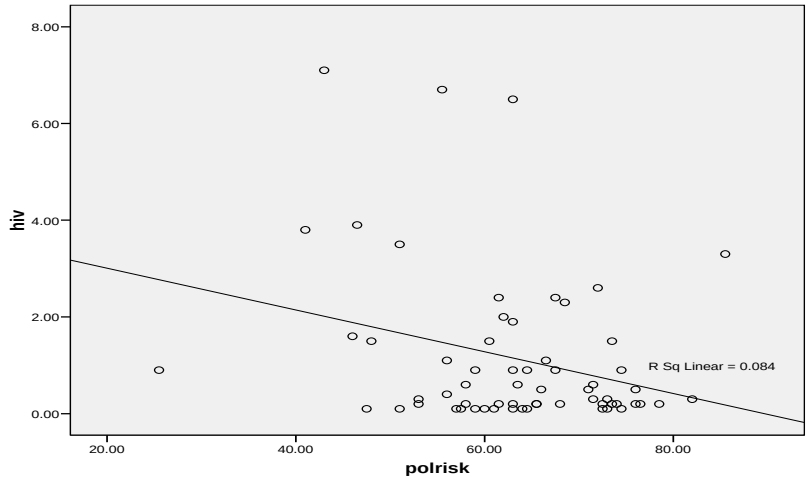
B=-4.805 (s.e.=1.204)

G) HIV PREVALENCE AND RULE OF LAW



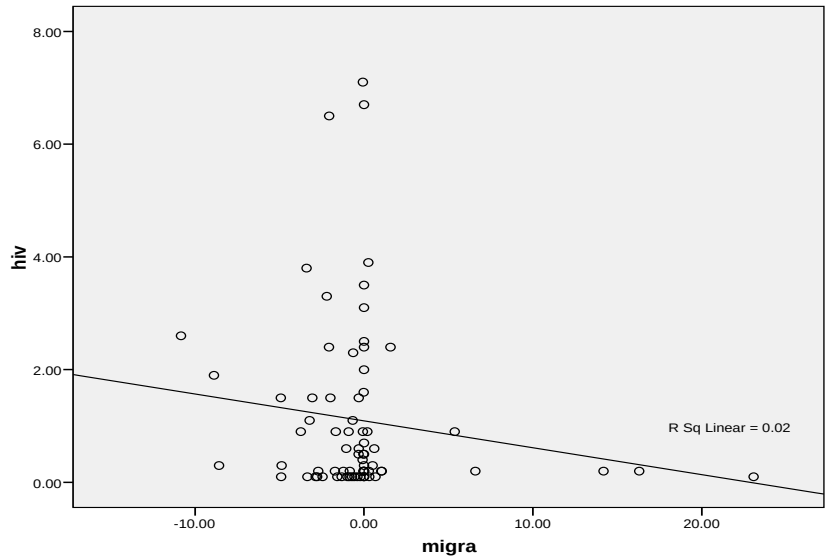
B= 0.009 (s.e.=0.08)

H) HIV AND POLITICAL RISK



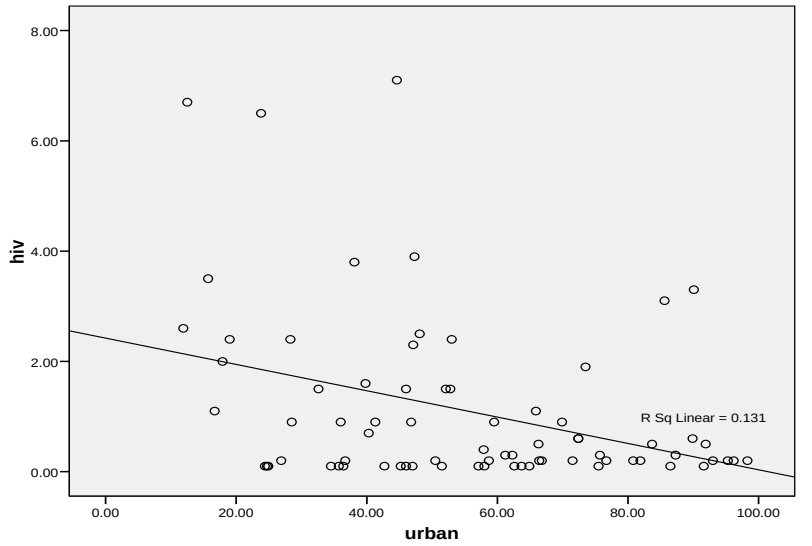
B=-0.043 (s.e.=0.018)

I) HIV PREVALENCE AND NET MIGRATION



B=0.142 (s.e.=0.085)

J) HIV PREVALENCE AND URBAN POPULATION



B=0.266 (s.e.=0.195)